chapter 3

THE TRANSPORTATION-LAND USE CONNECTION
Basics of Transportation-Friendly Communities

THREE GEOGRAPHIC LEVELS

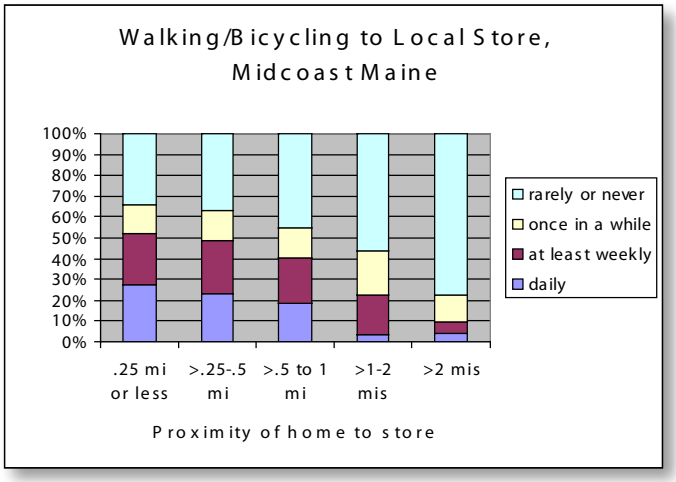
The transportation system operates at three levels: the neighborhood, the community, and the region. At each of these levels, transportation serves fundamentally different purposes – so each level must be designed accordingly.

At the **neighborhood** level, the transportation system connects land uses that are part of the personal territory of the neighborhood's residents. These land uses — homes, elementary schools, convenience stores, personal services, parks, and the like — play a huge social role, and the transportation system has to be compatible with that purpose.

The neighborhood is connected to the **community**, usually by means of a larger collector road that conveys residents to local commercial centers, town institutions, and other areas of town. At this level, the transportation system serves economic and social purposes in equal measure, as reflected by its dominant land uses — downtowns and shopping centers, town halls, medical offices, and high schools, for example.

And the community is part of a still larger **region,** served by a transportation system that includes major collector roads and long-distance arterials, rail lines, cargo ports, and airports. It moves commuters, freight, and visitors through the region and beyond. The regional transportation system plays mostly an economic role. It also provides access to one-of-a-kind land uses that rely on or serve large populations. The regional system provides access to and from major employers, distribution centers, regional malls, health care centers, tourist destinations, nature preserves, and regional transportation terminals and interchanges. Throughout the state, MaineDOT and the state's Regional Councils have identified "corridors of regional significance to transportation," and the department has built much of its Long Range Plan around these corridors.

Figure 3-1



Though both the transportation system and land uses are very different at these three levels, in each case the ways that transportation and land use interact come down to four factors that help to define the environment that is built around us. These are the "4 D's":

- Density
- Distance
- Diversity
- Design

Can changing the built environment – that is, the 4 Ds – really make a difference in the safety, efficiency, enjoyment, and longevity of the transportation system? Using two measures of demands on the road system – vehicle miles traveled and vehicle hours traveled – the best evidence from both national data and surveys in Maine is that the built environment does make a difference. For example, more than 50% of residents of the mid-coast who live within a quarter mile of a local store, and nearly half who live within a half-mile, walk or bicycle to the store daily or at least weekly. At more than a mile away, over half rarely or never walk or bicycle to a local store, and at more than 2 miles, over three-quarters rarely or never do. See Figure 3-1.

Strategies that make communities and regions friendlier to non-auto or shorter auto travel will shift some percentage of trips to walking, bicycling, ride-sharing and transit. Certainly auto travel will continue to dominate at all levels. But arranging the built environment in friendlier ways will bring balance into a system that has virtually eliminated choice in many communities and regions, with predictable effects on the highway system.

So, onto the 4 Ds.

Pricing vs. the Built Environment

Doesn't the transportation–land use connection really come down to something other than the 4 Ds, namely a very big P -- pricing?

Transportation technology provides us with wide choices of where to live, work, and carry out the many activities of living. Except for the elevator, which carried people skyward and helped shape city centers, innovations from animal cart to electric rail and, above all, the automobile have increased our freedom to move horizontally. Towns, cities, and regions have spread out accordingly.

The ability of the average person and business to take advantage of the widening circle of choices as to where to live and work requires public subsidies. For example, according to the Federal Highway Administration, auto and truck users pay about 60% of the costs of road construction and maintenance through fuel and vehicle taxes and tolls. Users, in the form of buyers of house lots, also pay for the construction of local roads in new subdivisions. But other taxes and fees are needed to supplement user revenues to maintain the system. In addition, taxes subsidize the "unseen" costs of an expanding system, including extra public safety, public works, school busing and environmental costs.

This is not a handbook on transportation economics, but we note the phenomenon of subsidized transportation because many experts argue that the most effective way to bring transportation and land use into sync is through pricing, such as expanding toll systems, increasing fuel taxes or taxing vehicle miles traveled. Pricing, they argue, allows the marketplace to allocate scarce resources most efficiently and requires those who travel more to pay more toward the unseen costs. As a result, land use decisions would take into account the true costs of transportation.

We acknowledge the importance of pricing, but for the most part the decisions about pricing rest with state and federal governments, not municipalities. Municipalities do have some pricing tools, such as impact fees, at their disposal – and we will discuss these in this handbook. However, our focus is on the basics of the built environment that can bring transportation and land use into better harmony, and over which local governments have some control.

THE FOUR D'S

Density

Density helps determine how much choice in transportation may be available to an area. For example, at low densities, the automobile frequently is the only practical choice. At higher densities, other choices, such as walking or taking a bus, are more feasible. In residential areas, density is measured in dwelling units or population per acre. In commercial areas, it is measured in employees per acre or the number of square feet of commercial space per area of land (floor area ratio or FAR).
See Figure 3-2.

Consider a neighborhood with a density of 3 dwelling units per acre and a school, a day care center, and a store nearby. Compare it with a neighborhood (of the same geographic size) with a density of 1 dwelling unit per acre and also a school, a day care center, and a store nearby. It is almost certain that the residents of the first neighborhood will walk or bicycle to nearby activities more frequently than those of

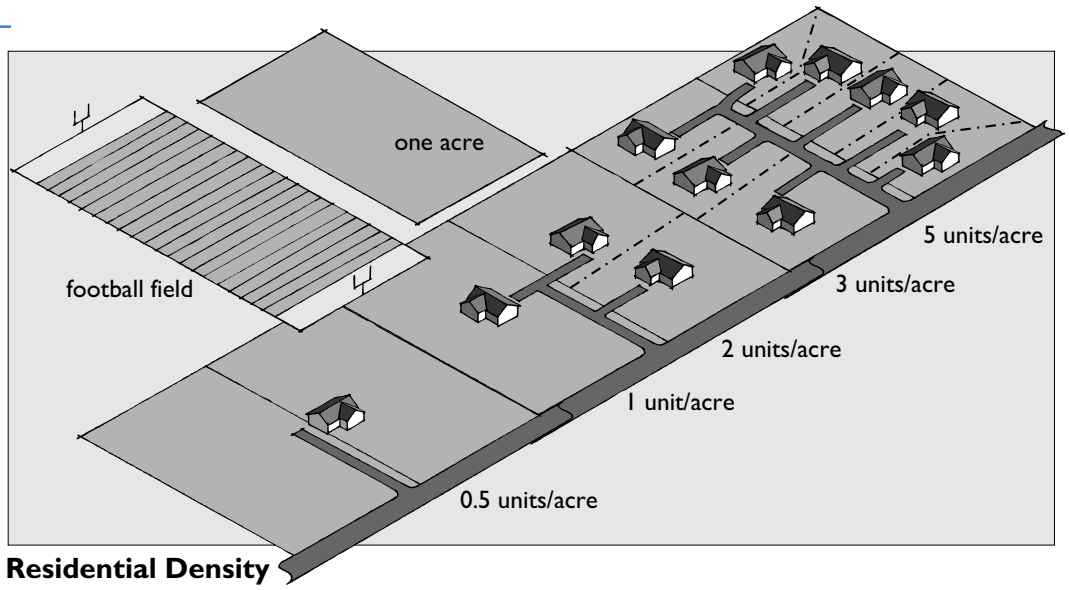


Figure 3-2.
Measures of Density

Residential density is number of dwelling units per acre. Floor area ratio (FAR) is a measure of commercial density. It is the total square feet in a building (all floors) divided by the total square feet of land in the lot. A one-story 10,000 sq. ft. building on a 10,000 sq. ft. lot has a FAR of 1.0. So does a two-story building with 5,000 sq. ft. per floor on a 10,000 sq. ft. lot.

the second. And the difference is magnified if residences are close to job centers.

Equally important to choice in transportation is that destinations outside of the neighborhood – like shopping areas and job centers – also have a degree of density. A single neighborhood settled at a moderately high density by itself has limited effect on transportation choice. It has to be connected to other neighborhoods, shopping areas and job centers that also exhibit some degree of density.

Density is not an easy topic to discuss. Too often, it conjures up worries about crowding and urbanization. At least in the context of the towns and cities of Maine, this is a bad rap: no community in Maine has high residential densities (15+ units per acre over a large area), and outside of Portland's peninsula and downtown, very few neighborhoods have even moderately high densities (5-15 units per acre). Fortunately, improving transportation choice requires only incremental increases in residential and commercial densities, even where densities must remain low because homes rely on septic systems and wells.

How Much Density Is Needed to Create Choice?

It depends. For carpooling, residential density does not matter as much as having a convenient parking area near a highway interchange or major intersection where many people can converge to share rides. For walking and bicycling and for certain types of transit, like demand-response services, a residential density of at least 1 to 2 units per acre can work (higher if public water and sewer allow it). For a fixed-route bus system with 20 runs per day, 3 to 5 units per residential acre appears to be the minimum at one end of the trip, with a commercial density at the other end of at least 700 square feet of building space (floor area) per 1,000 square feet of lot area (Floor Area Ratio = 0.7). These are modest levels of density, and some small towns have established centers that already are built to them.

Even so, density alone is insufficient to create the environment for choice in transportation. Choice also relies on distance between activities, on the mix of those activities, and on whether a neighborhood or community is designed for choice. And that takes us to the other three Ds.

Distance (or Accessibility)

"Distance" is more accurately described as "accessibility" (but then we wouldn't have 4 "D"s!). "Accessibility" refers to the ease with which a traveler can move from one point to another. It is measured by the distance between land uses and the time and cost of moving between them. If a child has to ride a school bus for 30 minutes at considerable cost to taxpayers to get from home to school, his accessibility to the school is quite low. If a shopper can hop on an interchange near home, travel on an uncrowded highway and be at a regional mall in a matter of minutes, accessibility to the mall is quite high. If a tourist staying at a downtown inn can walk to a variety of attractions, she is enjoying an accessible location.

Is There a Magic Distance?

For walking, the magic distance seems to be ¼-mile, or ½-mile at the outside. A good measure of the "walkability" of a neighborhood is the number of complementary activities – playground, convenience store, coffee shop, school, etc. – that are within ¼ to ½-mile of most residences

Diversity

Diversity refers to the variety of land uses accessible to each other at any of the geographic levels. It is an indicator of the number of activities that can be satisfied on a single trip with a given mode of travel. Studies show that the number of auto trips drops as the mix of compatible and complementary land uses in neighborhoods, downtowns, community shopping centers or job centers increases. Certain land uses are natural companions – such as homes, school, day care center, and stores like grocery, drug, and hardware, that sell everyday goods; or higher density housing, offices, restaurants, and financial services. If they are close together, a single trip covers them all. Of course, a mix of land uses isn't enough; they have to be close enough together and designed for easy accessibility to each other. If they are, the situation is ripe to "park once" on any given trip, or, in some places, not at all because a car was not needed in the first place.

On the flip side, a mix of land uses also is important to the operation of major transportation facilities, such as airports, rail lines, and major interchanges – but for the opposite reason. Here the goal is to encourage land uses that can take advantage of the facilities (such as manufacturers and distributors), while insulating the facilities from land uses that would consider them a nuisance.

Design

Design is the glue that makes a comprehensive transportation-land use system work. Design covers a lot of ground: the geometry and interconnection of streets, the management of access between roads and adjacent properties, the "streetscapes" of neighborhoods, and the "context" or character of the place served by the transportation system. Without good design, we find that distance, density, and diversity of land uses are less able to provide for choice, safety and efficiency of transportation.

• Geometry: Geometry refers to the basic dimensions and design of streets, sidewalks, bike paths, and trails. The critical dimensions include, among other things, width of right-of-way, width of paved surface, minimum and maximum grades, sight distances, and minimum and maximum radii of curves and intersections. Best engineering practices for the geometries of different classifications of streets are widely available and won't be duplicated in this handbook. We will, however, refer to and make use of some of these best practices as they relate to transportation choice and "livability" in neighborhoods and communities.

• Interconnection: Interconnection refers to the links between streets in a neighborhood, village, or community. It is fundamental to the form and function of a place. The degree of interconnection is measured by the number of "links" (road sections between intersections) divided by the number of "nodes" (intersections and cul de sac heads). See Figure 3-3. The greater the number of links per node, the greater the choices of pathways to get from one place in the community to another. Emergency vehicles, public works, delivery services, demand-response transit

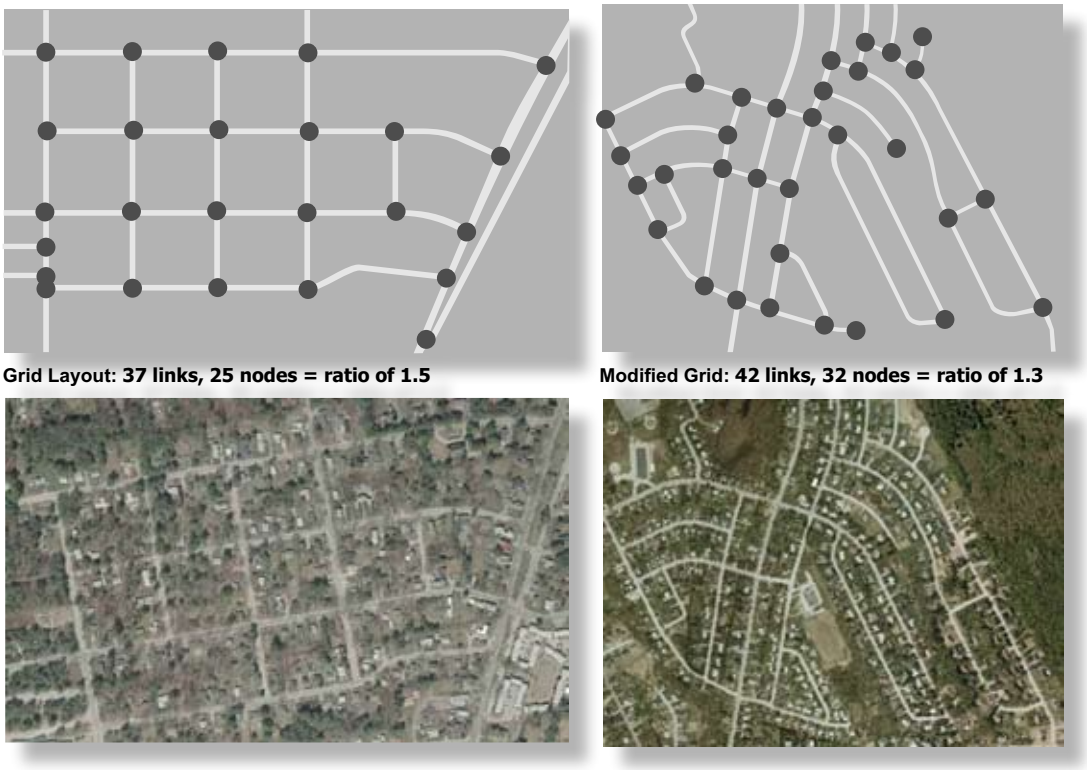


Figure 3.3
Links-to-nodes ratio

This ratio is a measure of interconnection of the street system and the choices people have to get from one place to another. In the example here, the grid layout is from a neighborhood in Brunswick, and the modified grid layout is from a neighborhood in Brewer. Each intersection, dead end, and cul-de-sac is a node. Each segment of street between nodes is a link. (Don't count links that are running out of the frame of the diagram.) The more links per node, the greater the connectivity of the neighborhood or community. Sometimes when it is not possible or desirable to create a street connection, a pedestrian or bicycle connection can serve a similar purpose.

services, and utilities (for looping of lines) all benefit from interconnectivity of the transportation system. A well interconnected system allows residents, including children, to move about the neighborhood without venturing onto busy streets, enables short neighborhood auto trips that avoid arterials, and allows cross-town trips to use direct secondary roads.

- Over the last century, the layout of neighborhood street systems has evolved in several forms, with different levels of interconnection. These forms are loosely grouped as grids, modified grids, loops and lollipops, and lollipops on a stick. See Figure 3-4.

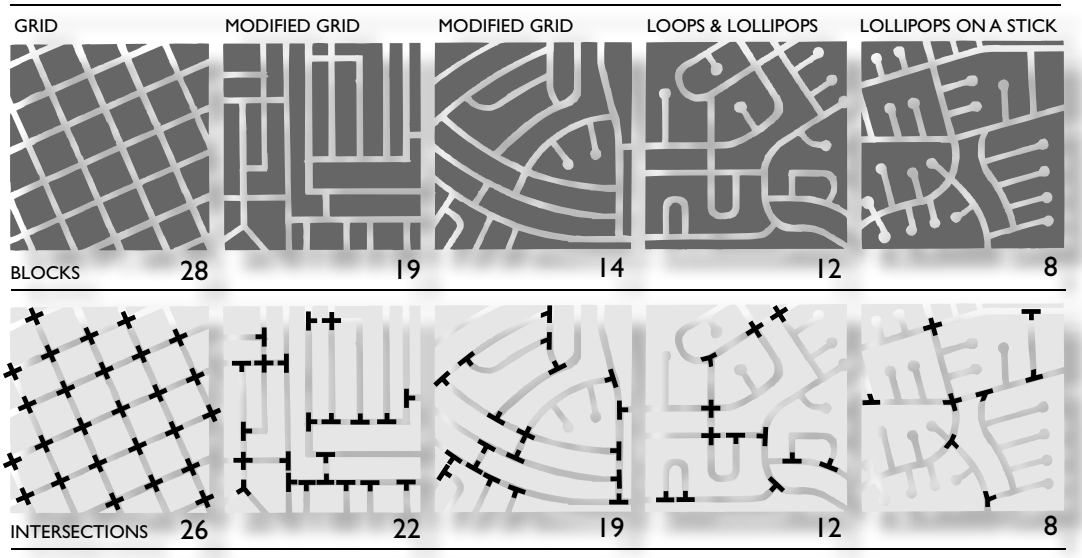


Figure 3-4
Evolution of neighborhood street layouts

Since the mid-20th Century, the layout of neighborhood streets has evolved from primarily interconnected with many internal blocks (grid) to primarily dead-end (lollipops on a stick) with few internal blocks.

From: Center for Urban Research; Florida Center: Transportation, Land Use and Sustainability

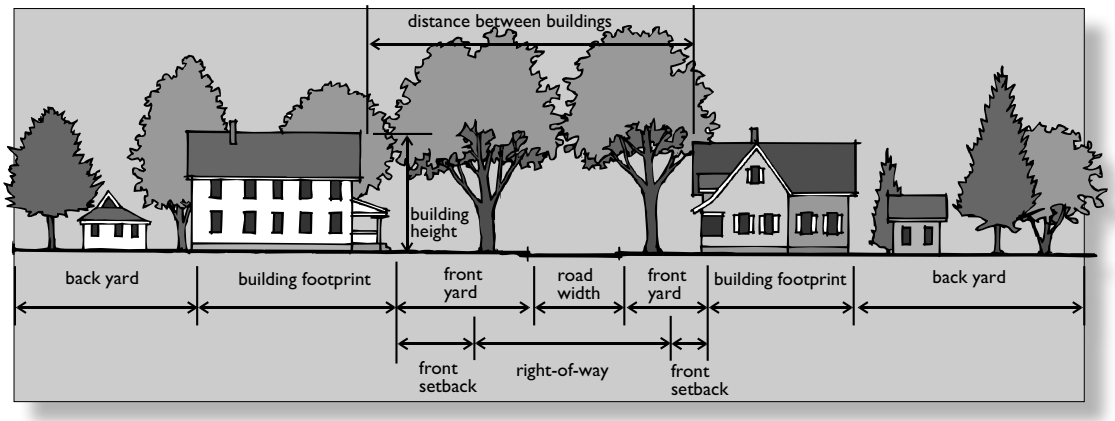
• Access Management: Access (not to be confused with "accessibility") to public roads is achieved with driveways, private ways, and openings called "curb cuts" that connect property directly to the road. Access management refers to the need to manage the number, locations, and design of these points of access. Why is there a need to manage this? Because access to streets is both necessary and a source of friction. Access should be geared to the geographic level – or major purpose - of the area being served. A lot of interaction between land uses and the street is expected along many local streets. For example, each home typically has a driveway. But along major collectors and arterial roads, whose function is to move people and freight long distances as smoothly as possible, as the number of access points increase, the friction increases – as do congestion, crash rates, and the costs (for traffic signals, turning lanes, extra travel lanes, and similar measures) to deal with it.

• Streetscape: A street is composed of several elements – travel lanes, shoulders or parking spaces, curbs, esplanades and trees, sidewalks, lighting, street furniture. The "streetscape" is the arrangement of these elements and of the land uses (buildings, parking, parks, etc.) adjacent to the street. A streetscape can range from a highly utilitarian space to a space that feels like a comfortable "outdoor room." See Figures 3-5 and 3-6. By design, arterials, collectors, and local streets have different streetscapes. Problems arise when the streetscape of one is imposed on another – for example, when the geometry and arrangement of elements needed for a collector street become the standards for a local street as well. Or, conversely, when the arrangement of land uses along an arterial pressures it to act as a local road and competes with the needs of regional travel.

Figure 3-5.
An outdoor room

Traditional neighborhood streets have the effect of an "outdoor room," with the homes across the street from each other forming the walls of the room and the tree canopy the ceiling. The "room" or "streetscape" has several important components: a public space that includes the paved street, which is not overly wide; esplanades with street trees and usually a sidewalk on at least one side. The front yards are semi-public space – privately owned, but socially connected to the street. A porch often serves as semi-private space, and a well designed back yard provides privacy, even if it is modest in size.

• Design to Protect Community Character: This is closely related to "streetscape," but goes beyond it. Every community has historic, architectural, scenic, landscape/habitat, rural, or other features that it doesn't want to lose. These could range from a rustic landscape of fields and stone walls to a village downtown with distinctive buildings, sidewalks, and customer parking. There may be a scenic or other "gateway" feature along a transportation corridor entering a region or town that either needs to be protected or refurbished. In transportation lingo, the recognition of the importance of preserving these features is known as "context sensitive design."



APPLYING THE 4DS AT THE THREE GEOGRAPHIC LEVELS

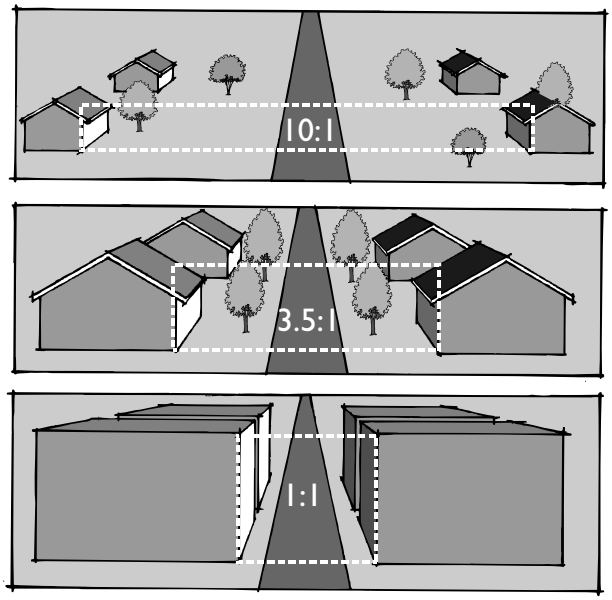


Figure 3-6.
Streetscape Proportions

In traditional neighborhoods of small to medium sized Maine towns, a typical streetscape proportion that creates an effective "outdoor room" is 3.5:1 -- the distance between buildings across the street from each other is about 3.5 times the height of the buildings. A 1:1 proportion is typical of some medium size downtowns. A low density suburb may have up to a 10:1 proportion, at which point the "outdoor room" has disappeared. Here, a premium is put on privacy all around the home, rather than on a continuum that includes public, semi-public and semi-private space, all as part of a streetscape, and the privacy of a back yard.

What follows are snapshots of what each of the geographic levels might look like when the 4Ds and the transportation system are well tuned to each other. These are not prescriptions, and there are many variations, depending on the size and circumstances of the community or region. However, these represent benchmarks for gauging how well the transportation–land use connection is being made. For illustration here we have in mind growing suburban towns or small service centers of 2,500 to 15,000 people. Much smaller towns (e.g., rural towns of under 2,000) or much larger towns and cities (e.g., 20,000+) might scale the benchmarks differently. However, the basic components, such as neighborhoods, villages, and collector roads, are the same in small and large towns.

Communities and regions that want to work toward these benchmarks in pursuit of a stronger transportation-land use connection can turn to Appendix B, where we offer policies and strategies to help get them there.

4 Ds in the Neighborhood

Neighborhoods take many forms. Here, we refer to two types typical of Maine towns: residential neighborhoods and villages.

Residential Neighborhood: A residential neighborhood (whether built or still developing) in a part of town intended to support growth and whose design provides residents with choice in transportation, safe travel, and quiet enjoyment of property might have these characteristics:

Distance and Diversity

- An area of about one-half mile across, covering 125-150 acres
- Primarily residential with ample open space (ideally, a park, playground, trails, or other open space within a quarter mile of each home)
- 3% to 5%, or several acres, devoted to neighborhood retail and services or civic uses (a school would require more space and be positioned for access by more than one neighborhood)
  - A typical resident can readily count two or three compatible, non-residential activities within easy walking distance (¼ to ½ mile) of home

Density

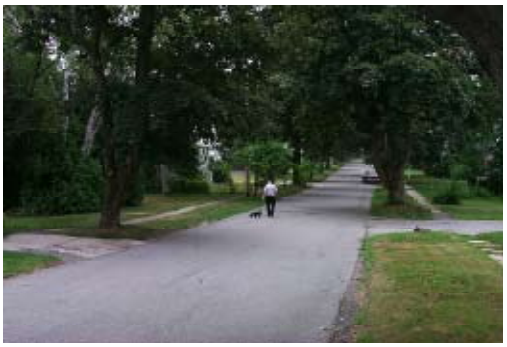
- If public sewer is available, a density of development that averages 3-5 dwelling units per residential acre, enough to support a variety of neighbor hood services (see also discussion of transit in Appendix B, Part 3)
- If on-site wastewater disposal is used but the neighborhood is part of the Town's growth area, a density of development that averages 1-2 dwelling units per residential acre, with frontages averaging 100 feet or less, creating a walkable scale despite low density

Design

- An interconnection ratio of at least 1.3, and preferably 1.4 links per node or more, using dead end streets sparingly, and with block lengths of 600-800 feet to slow auto speed and provide choices in pathways through the neighborhood (Figure 3-7)
- Where dead ends are necessary, a pedestrian path connecting to the next street in the neighborhood
- Neighborhood streets averaging under 500 vehicle trips per day (up to 1,000 trips is still okay for safety and quiet)
- Speed limit set both for safety and to keep traffic noise levels in check (see Table 3-1)
- A "streetscape" that feels like an "outdoor room," (see Figures 3-5, 3-6, and 3-8) with the neighborhood street's dimensions as shown in Table 3-1, and homes set back 15-20 feet, sufficient for privacy but close enough to the street so that the walls of the home create the "wall" of the "outdoor room."

Figure 3-7.
An interconnected neighborhood

Figure 3-8.
Example of an outdoor room, So. Portland



Design Feature	Neighborhood (Local) Streets	Rural (Major or Minor)
Speed Limit	25 mph	25 to 35 mph
Daily Traffic Volume	less than 1,000	1,000 – 4,000
Paved Width incl. shoulder	20' to 24'	28' – 32'
Number of lanes	2	2
Shoulder	No shoulder	3' – 5'
Curb and Gutter	Permitted	Permitted as needed
Sidewalks	Yes (5' minimum)	Desirable (5' minimum)
Crosswalks	Yes	Yes
Landscape Buffer or Planting Strip with Street Trees	Yes (desirable 8' but may be less or may be augmented by front setbacks); allows snow storage and aerial utilities	Desirable (8') if feasible; may be augmented by front setbacks
Bicycle Facilities	Yes, but unmarked	Yes, in shoulder
Driveways/Entrances	One per lot preferred but not required unless safe sight distance not met	One per lot preferred but not required unless safe sight distance not met
Signalized Intersections	No	Yes, where warranted only
Traffic Calming Devices [1]	Optional	Yes in accordance w/ MaineDOT Traffic Calming Policy
On-Street Parking	Yes	Permitted

TABLE 3-1. Design Features for Streets in Growing Sub-urb/Small Service Center

See also Figure 3-9
(Note: based on MaineDOT flexible design standards and guidelines)

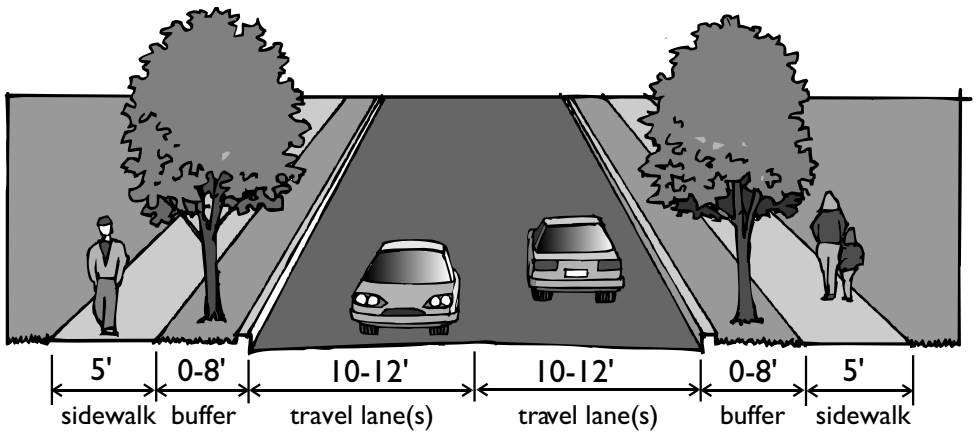


Figure 3-9. Dimensions of a neighborhood street

[1] Traffic calming devices include raised tables, chicanes, medians, diverters designed to slow traffic to MaineDOT traffic calming policy. See illustrations at Section 5.3 in Appendix B

Village: A village with a commercial core and residential streets around it is of a scale similar to a residential neighborhood, but the interactions of transportation and land use differ in a few key ways:

- The village core is 5% - 10% (several to 15 acres) of the neighborhood's area, with residential uses and open space occupying the rest
- Land uses in the core are varied, including civic, retail, services, and offices
- Within the core, the non-residential floor area ratio (FAR) is 0.6 or greater (or 600 square feet of building space for each 1,000 square feet of lot area, including off-street parking areas)
- The neighborhood extends about a quarter mile around each end of the core area
- The core is concentrated along a low speed collector or arterial that connects the village to other parts of town; it carries heavier flows of traffic than the local streets in the surrounding neighborhood
- Parking is on-street, or in one or more common off-street parking lots, or in small side lots
- Buildings in the core front on sidewalks at least 5 feet wide
- The surrounding neighborhood is well enough interconnected (link-to-node ratio of at least 1.4) that its residents do not have to turn onto the main street for every local trip
- See residential neighborhoods above for characteristics of the residential portion of village neighborhoods

4 Ds in the Community

A community with a sizeable downtown plus commercial uses along the road into town and designed for choice of transportation might have these characteristics:

Figure 3-10. Downtown Belfast: FAR=0.75

Distance and Diversity

- A downtown with several types of land use activities (including, for example, governmental or civic functions, fi nance, specialty retail, arts, education services, residential, restaurants, etc. – these vary from community to community)
- Downtown is up to ½-mile from end to end. Many of the activities are within ¼-mile of each other
- Where bus service is available or planned, public buildings and principal job and retail facilities are no more than ¼-mile from stops

Density

- Downtown floor area ratio of at least 0.7 to 1.0 (70 to 100 square feet of building space per 100 square feet of land contained within lots, including parking lots). See Figure 3-10.
- A range of residential densities, from low in designated rural areas of town, to 1 to 2 units per acre in growth areas that rely on septic systems, to moderately high near the center, including homes on small lots or apartments at 4 to 10 units per acre where public sewer is available.

Design

- Combination of rural collector roads and collectors and arterials that are more urban in nature
- Speed limit along in-town collectors and low speed arterials is 25 to 35 mph
- A continuous network of sidewalks, connecting neighborhoods and commercial areas in the town's growth areas
- In commercial districts outside of downtown along collectors and arterials, a floor area ratio of 0.4 or higher, with adjacent buildings and lots connected to one another at adjoining lot lines with pedestrian paths and connecting drives
- Accommodations for safe bicycle travel, including shoulders along collector roads and arterials or dedicated bike/pedestrian paths that create a continuous network among neighborhoods, town center, and other destinations in the community

Design Feature	Urban Collector Roads	Low Speed Arterials
Speed Limit	30 to 35 **mph**	**25 to 35 mph**
Daily Traffic Volume	1,000 to 4,000	4,000 to 10,000+
Paved Width/ incl. shoulder	30' to 36'	**28' – 32'**
Number of lanes	**2**	**2 to 4**
Center turn lane widths (when needed)	11' minimum	12' minimum
Shoulder – each side	4' – 6'	4' – 8'
Curb and Gutter	Preferred	Preferred
Sidewalks	**Yes (5' minimum)**	**Desirable (5' minimum)**
Crosswalks	**Yes**	**Yes**
Driveways/Entrances	One per lot preferred but two may be OK	One per lot preferred but two may be OK. Requires local permit only in Urban Compact areas; also requires MaineDOT permit outside Urban Compact limits

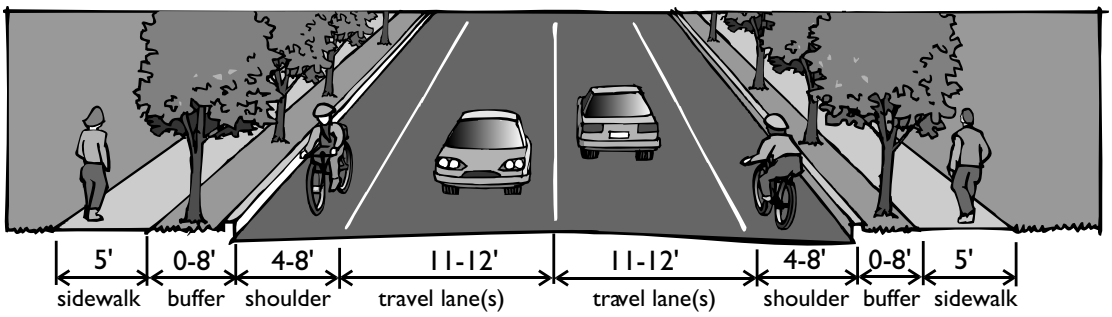
Table 3-2.
Design Features for Community Streets

See also Figure-3-11
(Note: based on MaineDOT flexible design standards and guidelines)

Design Feature	Urban Collector Roads	Low Speed Arterials
Landscape Buffer or Planting Strip with Street Trees	Yes (3 - 5' minimum); may be augmented by front setbacks	Recommended (5' min); desirable but not always feasible – may be augmented by front setbacks
Bicycle Facilities	In shoulder or exclusive bike lane IF there is a shoulder and/or adequate r/w to accommodate	In shoulder or exclusive bike lane IF there is a shoulder and/or adequate r/w to accommodate
Signalized Intersections[2]	Yes, when warranted	Yes, when warranted; spacing as outlined in MaineDOT access regulations
Traffic Calming Devices[3]	Yes, see MaineDOT Traffic Calming Policy for options	Preferred at pedetrian crossings only – see MaineDOT Traffic Calming policy for arterial options
On-Street Parking	Yes, 8' width	Permitted, 8' width

Figure 3-11.

Dimensions of low speed arterials



[2] See State of Maine Access Management Regulations

[3] Traffic calming devices include raised tables, chicanes, medians, diverters designed to slow traffic according to MaineDOT traffic calming policy. See illustrations at Section 5.3 in Appendix B.

4 Ds in the Region

Regions can be defined in different ways, but from a transportation point of view, they are especially aligned with labor market areas or a series of labor market areas connected by major transportation corridors. They thus cover a couple of hundred to several hundred square miles, may consist of several to 20 or more communities, and include corridors of 10 to 50 miles. A region with viable job, distribution, retail, and/or tourism centers, accessible to commuters and connected to other regions by a variety of regional transportation facilities, might have these characteristics:

Distance and Diversity

- Possibly one dominant job and retail center, but more likely several important centers in several communities, spaced 5 to 20 miles apart

Density

- A contiguous rural swath separating the centers
- Many undeveloped blocks of 500 acres and more, and overall actual density of development very low (less than 1 dwelling unit per 40 acres)
- Where rural land between the built up or "growth" areas of communities is being developed, allowed residential densities are low: 1 unit per 5-7 acres, or less
- New individual lots and driveways along major collector roads are discouraged
- Where there are subdivisions, "conservation" subdivisions are preferred (homes are clustered within large area of open space – See Figure 3-12)
- Regional balance between jobs and housing, with many of the jobs located in mixed use commercial cores with FARs of 0.6 or 0.7 or more, and many of the homes in neighborhoods arranged to allow transportation choice (see 4Ds in the Neighborhood)

Figure 3-12.

A Conservation Subdivision

Photo by Terry DeWan

Design

- Communities connected by major collectors or arterials that are limited access or managed so that, in between the communities, the maximum number of access points for each mile is 30 on roads with 40 mph speed limits; 20 on roads with 45 mph speed limits; 15 on roads with 50 mph speed limits; and 10 on roads with 55 mph speed limits (access points that are directly across the road from each other and function as an intersection count as one)
- Park-and-ride and vanpool lots located adjacent to highway interchanges or intersections of major state routes
- Demand-response transit service available to most communities in the region
- Regional fixed-bus service available on at least weekdays in communities with at least 1,000 people per square mile or, if connecting to a regional service center, at least 500 people per square mile

- May have designated truck routes to bypass neighborhoods and down towns
- Residential development outside of noise and safety contours around regional airport
- Land near rail lines with opportunities for sidings reserved for industrial and distribution purposes or with substantial setbacks, berms, and buffers required of residential activity that locates nearby

Table 3-3. Design Features for Regional Roads and Highways See also Figure 3-13

(Note: based on MaineDOT flexible design standards and guidelines [4])

Design Feature	Moderate Speed Rural Collector	Moderate Speed Arterial	High Speed Rural Arterial
Speed Limit	40 + mph	40 mph	45 to 55 mph
Daily Traffic Volume	Less than 10,000	Over 10,000	Over 10,000
Paved Width	28' to 36'	44' to 72'	44' to 72'
Number of lanes	2	2 to 4 lanes	2 to 4 lanes
Shoulder each side	3' – 6'	4' - 8'	6'- 10'
Curb and Gutter	Not typical; usually ditch	Not typical; usually ditch	No
Sidewalks	Off-road preferred	Off-road preferred	Off road only
Crosswalks	No	No	Not permitted
Driveways / Entrances	Limited in number, and requires a permit from MaineDOT	By local permit only in Urban Compact communities; MaineDOT (and possibly local) permit required outside urban compact limits	Limited in number, location, design with permit from MaineDOT outside Urban Compact limits; may also require local permit)
Landscape Buffer or Planting Strip	On backside of ditches	Recommended (5' min) – depends on drainage, r/w and overhead utility needs	Recommended (5' min) – depends on drainage, r/w and overhead utility needs
Bicycle Facilities	Exclusive bike lane or shoulder recommended and evaluate separated facilities when warranted	Exclusive bike lane or shoulder recommended and evaluate separated facilities when warranted	Exclusive bike lane or shoulder recommended and evaluate separated facilities when warranted

Design Feature	Moderate Speed Rural Collector	Moderate Speed Arterial	High Speed Rural Arterial
Signalized Intersections	Yes, ½ mile spacing minimum when warranted – see access regs for limits	**Yes, where warranted only**	Yes, ½ mile (2600') spacing minimum when warranted – see MaineDOT access regs for spacing based on speed limits
Traffic Calming Devices [5]	Yes – see MaineDOT policy	Yes but with some limits based on MaineDOT _Traffic Calming policy	No
On-Street Parking	Undesirable	Undesirable	No

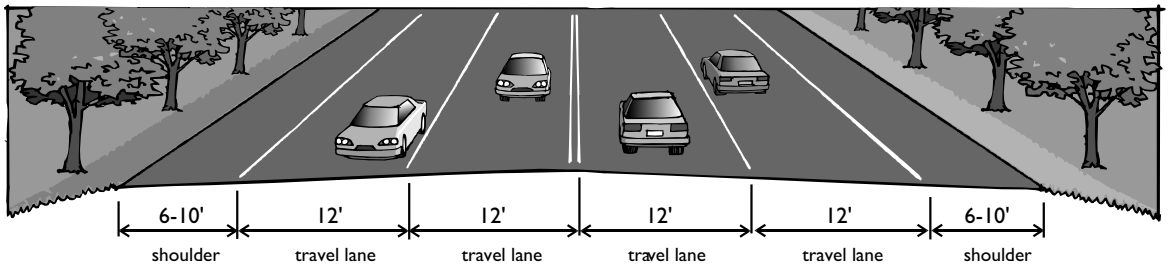


Figure 3-13. Dimensions of high speed arterials

[4] Each roadway is evaluated on a case by case to determine the best fit in view of many factors relating to land use, function and resources that might be affected. Exceptions to these basic standards are allowed when properly documented

[5] Traffic calming devices include raised tables, chicanes, medians, diverters designed to slow traffic according to MaineDOT traffic calming policy. See illustrations at Section 5.3 in Appendix B.